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The pig sector in North East India: status, constraints and opportunities

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Introduction

The eight states in North East India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura) are ethnically and culturally akin to South East Asia and are amongst the poorest in India with a much higher proportion of the population below the poverty line (35%) than the national average (26%). Agriculture is the prime source of livelihood for the majority (85%) of the rural population in this region. It is characterized by subsistence, low input-low output, technologically lagged mixed farming systems, and is dominated by smallholders. Although cereals dominate the cropping pattern in this region, livestock are an important component of the mixed farming systems and dependence on livestock as an alternative source of income is significant with livestock accounting for 18% of the value of output from the agriculture sector (Kumar et al., 2007). In addition, livestock have important social, savings and insurance roles in the livelihood systems.

For the majority tribal population, livestock keeping – especially pig keeping - is integral to their way of life, with 3.8 million pigs (over one quarter of the pigs in India) in the NE Region. There is a growing demand for pork due to increasing per capita income, urbanization and changes in lifestyle and food habits. Much of this demand is met from imports from other states in India and from Myanmar. Despite the significant potential for pigs to contribute to the improvement of livelihoods there have been few systematic studies of the pig sub-sector that can aid the design of effective development programs in the region.

The objective of the studies reported in this paper were to undertake rapid appraisals of the pig sub-sector in two of the states in North East India, Assam and Nagaland, to a) build a comprehensive understanding of pig systems, and b) identify entry points for effective public and private sector interventions for developing the pig sub-sector within a pro-poor market-oriented strategy to improve livelihoods.

The participatory approach to the design and the implementation of the appraisals –drawing on the knowledge of consumers of pork, market agents, pig producers and the partner R&D agencies – aimed to strengthen both the client-orientation of, and the institutional linkages amongst, the R&D agencies.

Methods

Assam and Nagaland were selected for the appraisals because Nagaland has the highest pig density of the eight states (0.6 pigs/person; Table 1) and Assam has by far the largest human population (nearly 70% of the region's total; Table 1) and is the largest market for pork. In addition the key R&D agencies in the two states were keen partners in the design and implementation of the studies. Two complementary approaches were used to carry out the appraisals. Firstly, a review of secondary information was

conducted and secondly, primary data were collected by semi-structured interviews from actors along the pig value chain. Interviewees included consumers, market agents, producers, service providers (private and public) and key informants at village and district levels. The interviews were based on checklists drawn up for each category of interviewee. Information was collected on the population and income groups engaged in pig production and marketing; the relative importance of piggery in livelihood strategies; production practices (feeds, breeds, disease control and reproduction); pig productivity and profitability; market chains and the actors involved; consumer demand and preferences; support services (particularly genetics/reproduction); an approximate timeline of changes (i.e. the dynamics of the systems) and the interviewees' perspectives on constraints and opportunities (i.e. the scope for improving the productivity and profitability of pig systems). To ensure that the results of the field surveys reflected the variation observed for pig production and marketing in the two states, five contrasting yet complementary districts were selected from the 23 districts in Assam (as at 2004) and 3 districts were selected from the 11 districts in Nagaland. Selection was based on diversity of ethnic groups, geographical location, agro-climatic zone, production system, pig population and market opportunities and how these factors were thought to influence the variability of pig systems in the state. The choice of sample districts was guided by the information available from secondary sources and the field knowledge of the key resource persons from the partner R&D agencies. The districts were Dhemaji, Golaghat, Kamrup, Karbi Anglong and Kokrajhar in Assam and Dimapur, Mon and Phek in Nagaland.

Table 1: Human and pig populations in the North East states of India

	Arunachal Pradesh	**Assam**	**Manipur**	**Meghalaya**	**Mizoram**	**Nagaland**	**Sikkim**	**Tripura**	**NE India**
Area (km^2)	83743	78438	22327	22429	22081	16579	7096	10486	263179
Population ('000)	1203	29564	2374	2540	973	2180	593	3505	42932
Pigs ('000)	330	1543	415	419	218	644	38	209	3816

Source: North Eastern Development Finance Corporation Databank (http://www.db.nedfi.com)

Within each sample district, and in consultation with key resource persons, district veterinary officials and some district-level market agents, three clusters were identified where the semi-structured interviews were carried out at village and household levels. For each cluster, interviews were carried out in two villages and in three households in each village. In each of the surveyed districts, one cluster was selected within 5–10 km from the district headquarters and the other two clusters 30–70 km away from the district headquarters in different directions. Efforts were made to include the principal areas of pig production and the expected variation for ethnic group, production system and market opportunities. Likewise, within each cluster two villages were identified from a list of about ten villages after detailed discussions with the staff and Veterinary Assistant Surgeons (VAS) of the local veterinary dispensaries about the demographic and livelihood patterns, the roles of crop agriculture and livestock, the concentration of pigs, the variation in ethnic groups and the proximity to markets. Generally, for each pair of villages within a cluster, one was selected nearer to the market. Variation for ethnicity and concentration of pigs was also considered.

The field surveys were carried out in September to December 2006 in Assam and May to June 2007 in Nagaland.

It should be emphasized that the appraisal studies were designed to identify key issues that are likely to be responsive to development interventions or that require research to fill gaps in knowledge, rather than to provide definitive answers to specific questions about pig systems.

Results

Pork consumption and marketing

North East India has much higher pork consumption that the rest of the country. Table 2 shows consumption for three states. Of these states, Nagaland has the highest per capita consumption. The tribal population in particular appears to consume more pork on average than other groups. Traders in both Assam and Nagaland reported that the demand for pork was increasing along with prices (Table 3).

Table 2: Per capita consumption of pork (kg per annum) in urban and rural areas and for rural social groups in three northeastern states

State	Rural	Urban	Scheduled Tribes	Schedules Castes	Other Backward Castes	Others
Assam	0.09	0.61	2.26	0.44	0.49	0.21
Meghalaya	3.26	2.04	2.14	0.00	2.26	0.15
Nagaland	9.54	7.18	7.45	1.61	4.14	1.80

Source: National Sample Survey Organization (2003)

Table 3: Average pork prices (Indian Rupees per kg) and percentage changes in the three surveyed districts in Nagaland.*

	Dimapur	Mon	Phek
1997 (A)	50	60	40
2002	60	70	60
2007 (B)	90	100	90
B/A actual (%)	+60	+66	+125
B/A adjusted for inflation (%)**	+17	+8	+46

*1 USD = 45 Rupees
**Adjusted by the All India Consumer Price Index (http://indiabudget.nic.in)
Source: key informants during market survey

In the pig sub-sector's output market there are three principal products: weaner piglets, slaughter pigs and fresh pork. Piglets are the first product in the supply chain. Figure 1 gives an example of the market supply chain for piglets from Golaghat District in Assam, with the approximate percentage of piglets marketed via different channels. Although the proportion of piglets marketed via different channels varies between districts and states, the basic structure of the marketing channels is similar.

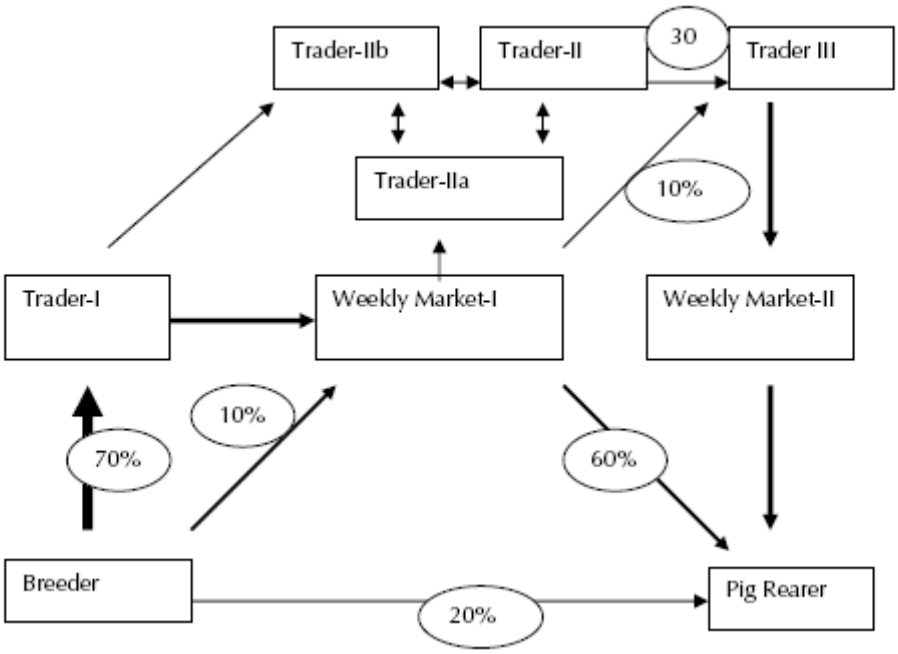

*Figure 1: Supply chain for piglet marketing in Golaghat District, Asssam (S*ource: key informants during the field surveys)

Trader-I: Procure piglets from local breeders to sell in local village weekly markets and/or to visiting traders from outside the district
Trader-II/IIa/IIb: Local traders who procure piglets from the Trader-I/breeder and sell it to other local traders (IIb/IIc)/local pig rearers/ visiting traders from other districts (Trader-III)
Traders-III: Traders from other districts who procure piglets from Trader II/ breeder and sell it in their respective markets of the district/state
Market-I: Weekly markets of Golaghat district
Market-II: Weekly markets of other districts

Table 4: Percentage of slaughter pigs sold in different market chains in five districts in Assam and three districts in Nagaland (Source: key informants during the field surveys)

	Assam					**Nagaland**		
	Dhemaji	**Golaghat**	**Kamrup**	**Karbi Anglong**	**Kokrajhar**	**Dimapur**	**Mon**	**Phek**
Self Sufficiency	Small surplus	Large Surplus	Deficit	Small deficit	Small surplus	Large deficit	Large deficit	Large Deficit
Local rearers to consumers	10	10	<10	20	30	30	80	90
Local rearers to local retailers	80	60	80	70	60			
Local rearers to traders at local market						10	10	10
Local rearers to traders for external market	10	30	0	0	10			
External rearers to traders at local market	0	0	>10	10	0	60	10	0

In Assam the predominant route for marketing of slaughter pigs is from rearer to retailer while in Nagaland most pigs are sold directly to consumers and only a small proportion is sold to traders at local markets. In some districts such as Dimapur which included the state capital (Kohima) and had a large deficit of pigs, traders procure pigs from other parts of India, including Uttrar Pradesh and Haryana.

In the NE states there is little or no formal infrastructure for the slaughter of pigs or selling of pork, which raises concerns about public health and food safety. Pork is generally sold at the roadside or at weekly markets. Subsequently a risk assessment of representative pork supply chains in Nagaland revealed high levels of hazards (e.g. coliforms, an indicator of faecal contamination; *Staphylococcus aureus*, a food-borne disease and an indicator of bad meat handling). Butcher practices in meat handling and consumer practices in cooking have little influence on levels of hazards; i.e. the hazards found were in such high levels that even if risk-mitigating practices were put in place by some butchers and consumers, they would have made little difference. The results of the risk assessment pointed to the slaughter-point as the main entry point for targeting effective interventions to reduce risks to food safety in the pork supply chain in Nagaland.

Pig production systems

A high proportion of households keep pigs. Depending on the community, between 60 and 90% of households in the surveyed districts in Nagaland keep pigs while in Assam the figure ranged from 20 to 90%. In both Assam and Nagaland the majority of pig-keeping households keep only fattening pigs with only 10-30% of households keeping breeding sows. Some households have both breeding and fattening pigs.

Fifteen to twenty years ago, scavenging was the traditional method of rearing, but recently this has been replaced by penned systems. In Nagaland 80-100% of pigs are now penned while in Assam it was only in Dhemaji District where significant numbers (70%) of scavenging pigs were found. The change has been brought about primarily because of the need to reduce crop damage. In Nagaland many village councils have banned scavenging, based on advice from church leaders.

In the surveyed districts in Assam pig keepers mostly preferred black-coloured piglets with drooping ears and an elongated body and specifically the types known locally as “Australian”, which are crosses between Large Black and indigenous pigs. Their black colour was important especially for those who rear pigs for religious purposes. Piglets of the Large White/Yorkshire and Hampshire breeds were less popular in all the surveyed districts. In Nagaland market agents and producers reported that previously the pig population was almost entirely indigenous. However, with the growth in demand for pork and its role in income generation, indigenous pigs were gradually substituted with cross-bred pigs imported from the neighbouring states of Assam and Manipur and from Myanmar. Piglets imported from Assam are mainly Large Black crosses, while those from Manipur and Myanmar are generally Burma/Bilati crosses. The majority of pigs in Nagaland were, however, of indigenous breeds with cross-breds ranging from 20% in Mon District to 100% around the large towns such as Dimapur where there is a large demand for pork. There is a considerable difference in performance between indigenous and cross-bred pigs, especially high-grade cross-breds (Table 5).

Table 5: Reported performance of pig genotypes in Nagaland

Trait		**Cross-bred**	
	Indigenous	**Low-grade**	**High-grade**
Farrowing interval (months)	6-8	7-9	6-8
Number of litters per lifetime	4-6	4-6	4-6
Litter size at birth	2-6	4-10	7-16
Litter size at weaning	1-4	3-8	6-10
Age at weaning (days)	90-105	60-120	50-60
Liveweight at 10 months (kg)	15-20	30-40	80-90

Source: key informants during the field surveys

In Assam there was little planned breeding and so it was not possible to be certain of the degree of exotic blood in the pigs. Just as there was a lack of systematic crossbreeding, there were few purebred indigenous or exotic pigs. Government and research farms were the sources of the latter. For example, key informants in Dhemaji district mentioned that in the early 1980s, the government pig breeding farm at Dirpai, Dhemaji and Nirijuli pig breeding farm in Arunachal Pradesh and a few progressive pig breeders and missionary schools introduced the Large Black breed to Dhemaji and Lakhimpur districts and to Arunachal Pradesh. Some exotic pigs are currently available from the Animal Husbandry and Veterinary Department and College of Veterinary Science breeding farms which have Hampshire, Large Black, Saddleback and Large White/Yorkshire breeds, of which Hampshire pigs are the majority. Pig producers in Nagaland bought breeding and fattening stock from three sources: small-scale producers who kept sows (about 70-90% of supply), from outside the state (Assam, Manipur and Myanmar; 10-30% of supply) and from the Veterinary and Animal Husbandry Department pig farms (< 1%). Between 2006 and 2007, only 1370 piglets were available from the VAHD breeding farms in the three surveyed districts. Most producers purchase crossbred piglets from nearby households where they can check the health status and age of the piglets, discuss the price and take into account their previous experience of rearing similar pigs. Households in Phek and Dimapur prefer to buy imported piglets from Manipur and Myanmar, while those in Mon and Dimapur import piglets from Assam.

There were no reports of the use of artificial insemination in either Assam or Nagaland. In NE India only in Mizoram, where 90% of pigs are improved genotypes, is there an artificial insemination service. Cross-bred boars are used for breeding until they are3-4 years old and sows until they are 3-5 years old, producing 4-6 litters. Thereafter the parent stock is usually replaced by its own progeny. Households without a boar usually use one from a neighbouring household. The service fee varies considerably from district to district (Rs 50-700).

Most households in the surveyed districts feed their pigs using family labour and feeds gathered from common-properties or produced by the household on their smallholder farms and in their backyards. Purchase of feeds, apart from some crop and milling by-products, was not common and, except for a few small-scale commercial units and government pig farms, the use of commercial concentrate feed was negligible. The composition of the diet varies according to the predominant cropping system. In rice-based systems the major feed sources were rice polish and *juguli* (the residue from a rice-based country liquor), although there are variations in feeding practices according to ethnic group and location. Colocasia (*Colocasia esculenta*) or taro is an important feed in most communities. Tapioca (cassava) was an important feed in some districts in Assam and in Nagaland. A limited amount of maize was fed in Nagaland. In urban and peri-urban areas kitchen and hotel waste was fed. The growth rate of pigs was invariably limited by the low nutrient density of the available feeds.

Key diseases reported by veterinary staff and producers were swine fever, internal worms, piglet diarrhoea, pneumonia, piglet anaemia, mange, haemorrhagic septicaemia (HS) and foot and mouth disease. Anthrax was also mentioned in Kokrajhar district of Assam. Of these, internal worms, swine fever, pneumonia and piglet diarrhoea were said to be significant. However laboratory diagnoses were rarely if ever carried out. Despite the reported prevalence of swine fever and the mortalities it caused, there were very few or no instances of vaccination against swine fever in Assam. Even in Kamrup District (where the headquarters of the Animal Husbandry and Veterinary Department (AHVD) and the College of Veterinary Science (CVSc) are located), only about 20% of producers vaccinated their pigs against the disease. In Nagaland fewer than 1% of producers vaccinated their pigs against swine fever, apparently because of inadequate knowledge of this preventive measure, poor availability of the vaccine and the fact that the vaccine, when available, comes in a vial of five or ten doses, more than required by most pig keepers. There were also reports of swine fever in vaccinated pigs, suggesting vaccination failure.

In Assam and in Dimapur District in Nagaland, richer producers (especially breeders) may call a veterinarian to treat their animals but poor producers generally try to treat their animals themselves, often using human medicines or with traditional medicines. In many parts of NE India there is virtually no veterinary service and generally a very low level of awareness among producers of pig diseases and preventative measures.

Institutional issues

There are a number of programmes and projects being implemented by government and donor agencies in support of the pig sub-sector including the supply of information from research, improved breeding stock, production training, extension and credit. For example, in Assam Self Help Groups (SHGs) are being promoted by government in each block. Of the thousands of SHGs that have been formed in Assam, the majority have taken up weaving, pig rearing, farm mechanization and sericulture. Key informants said that the success rate of SHGs, in terms of running the activity and repaying the bank loan, is about 30%. Most SHGs in tribal-dominated areas are taking up pig rearing. There are government pig breeding farms in both Assam and Nagaland aiming to produce piglets for distribution to smallholders although the numbers of piglets in relation to the size of the pig population is tiny. Many of these farms produce white cross-bred pigs but, as stated previously, producers and the market prefer black pigs.

In both Assam and Nagaland the AHVD run veterinary dispensaries, but in Nagaland they contribute little to strengthening the capacity of communities to improve animal health management as they have inadequate physical infrastructure and financial resources. In Assam there are veterinary dispensaries in each district but the services provided varied in quality with generally poor resources and lack of incentives for effective service delivery. In both states the surveys revealed that there was a lack of coordination among the different institutions promoting pig production. There was virtually no integration of research results from Veterinary Colleges and Research Institutes into government programmes and researchers appeared to be unaware of ongoing government schemes or the problems faced by those who implement programmes and projects in the field.

Conclusions and key recommendations

The methodology used proved effective in providing an overview of the pig sub-sector in Assam and Nagaland. Through consultations with actors along the market chain from consumers of pork to retailers, pig traders and pig producers, and with the organizations which serve them, it was possible to compile a detailed overview of the pig sub-sector in the two states, the first systematic review of the pig value chain to be undertaken. The study showed that pig production was invariably a small-scale backyard activity with 1-5 (Assam) or 1-3 (Nagaland) pigs per household. These low-external input enterprises depend upon family – mainly women's – labour and on other local inputs, particularly feed, of no or low opportunity cost. There are indications that pig production is gaining a foothold in Assam as a source of income generation in communities that do not have a tradition for rearing pigs. In Nagaland and tribal communities in Assam pig keeping is an integral part of the culture. But pig keeping is increasingly seen as a significant source of income as demand for pork increases and prices rise. The dependence on locally available feed resources, lack of good quality piglets and poor animal health care all limit productivity but the use of household labour and other resources with little or no opportunity cost means that pig production is still an attractive, profitable small-scale enterprise.

Given the structure of pig production and the demand and supply scenario, there appears to be considerable scope to try to overcome the constraints faced by the pig sub-sector in Assam and Nagaland and thereby to exploit the potential to increase the scale of pig production and to improve its productivity and profitability for these resource-poor households. The results of the appraisal study show that some guiding principles will be critical for the success of interventions in the pig sub-sector:

1. Improved efficiency and profitability of production should be achieved by incremental changes to better utilize existing resources through innovative community-based programmes implemented by client-oriented staff;
2. Participatory methods to identify and target priority problems and to develop and test interventions for specific locations will be essential to ensuring ownership and acceptability among the communities;
3. A key element will be to identify and promote current best practices of the most successful community members.

Allied to these principles will be putting in place mechanisms for institutional sustainability through:

1. Having a strong component of capacity building in participatory methods for local institutions and the target producer groups through hands-on training and exposure visits;
2. Ensuring that services are on a paid-for basis;
3. Avoiding programme components that are free or highly subsidized and ensuring that any subsidy is reduced in a phased manner over a short period;
4. Ensuring that public interventions have built-in staff incentives and effective monitoring and evaluation processes.

A participatory, action-research approach will ensure that the interactive, iterative process of identifying constraints, evaluating options to resolve the constraints and assessing the benefits meets the needs of the pig-producing households and groups to improve their husbandry while increasing their capacity for innovation. Through continuous information-sharing within their communities and groups and with their R&D partners, the base of locally relevant knowledge is increased. The process also facilitates the strengthening of institutional linkages and effectiveness amongst the R&D organizations including the agencies giving credit, the provision of which may play a key role in supporting the adoption of technical innovations.

A number of specific recommendations emerged from the study and are summarized below. Full details are given in Deka et al. (2007) and Deka and Thorpe (2008).

Recommendation 1
Through location-specific programs for ethnic and social groups, apply participatory methods and action-research to improve the feeding management of pigs. Women should be the main partners in the programmes

Recommendation 2
2.1 Through participatory methods, develop innovative community-based systems for early clinical diagnosis and control of swine fever and FMD.
2.2 Support the training of fee-earning technicians for the provision of veterinary services in the community-based schemes.

Recommendation 3
3.1 Government breeding programmes should include the Large Black breed preferred by most producers and should produce quality Large Black crossbred boars for sale to villagers for use in the prevailing fee-paying mating system.

3.2 Through participatory methods, develop innovative community-based systems for sustaining crossbred pig populations and for the *in situ* conservation of indigenous pig breeds.

Recommendation 4
4.1 Carry out a risk assessment along the pork production-to-consumption value chain to identify critical intervention points for improving meat hygiene and food safety.
4.2 Support training for a quality assurance programme to address the deficiencies in the management of pigs, their slaughter and the handling of pork in order to improve meat hygiene and food safety.
4.3 For training of trainers, the courses given by the Animal Products Development Centre in the Philippines should be considered.

Recommendation 5
Carry out a study of consumer preferences and perceptions of pork quality – including aspects of taste, appearance and composition – to inform private investment and public planning.

Recommendation 6
6.1 Support a programme of capacity building in participatory and action research methods.
6.2 Establish a planning and coordination group as a platform to catalyze the process of mindset change and to prepare a policy on the development of the pig sub-sector.

Recommendation 7
Support the training of local NGOs in credit lending and financial management to facilitate the provision of micro-credit to small-scale pig producers and traders.

A number of these recommendations are now being implemented and tested by the International Livestock Research Institute and its partners (research institutes, NGOs and government departments) as part of an ongoing programme of research and development in the pig sub-sector in NE India. These support systematic approaches to understanding and responding to demand-led opportunities for improving rural and peri-urban livelihoods through market-oriented pig production and the strengthening of institutional capacities at all levels.

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